Motorway-to-Motorway Metering Pilot Scheme

TN017 - Environmental Assessment Report

October 2015

Highways England

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Highways England, Piccadilly Gate, Store Street, Manchester M1 2WD

Mott MacDonald, Stoneham Place, Stoneham Lane, Southampton, Hampshire, SO50 9NW, United Kingdom
T +44 (0)141 222 4500 F +44 (0)141 221 2048 W www.mottmac.com

Executive Summary

This Environmental Assessment Report (EAR) presents the Environmental Impact Assessment (EIA) that has been prepared for the proposed Motorway to Motorway (M2M) Metering Pilot Scheme (the Scheme). The Scheme is a pilot that is being promoted by Highways England, which would involve the control of traffic on the links between the M6 and M62 motorways by the use of traffic signals and also the control of the main carriageway using Variable Mandatory Speed Limits (VMSL). These would be implemented by five gantries with individual lane speed indicators and three MS4 signs, with associated cabling within the verges. These would be coordinated to reduce journey times and delays.

Speed indicators may also be used on the link roads from the M6 to slow traffic down on the approach to the traffic signals, although the scheme design is still to be finalised.

Traffic signals timings would vary depending on the prevailing traffic conditions. The control on the link roads from the M6 and M62 motorways would be implemented in such a way that queues on the link roads would not interfere with the flow of traffic on the M6. VMSL would be used on the main carriageway to smooth the traffic into and through the section, thereby leading to a reduction in lane changing and a lower speed differential between lanes. It is intended that equipment be left in-situ at the end of the trial, which is anticipated to last for 12 months.

The Environmental Scoping Assessment prepared for the Scheme identified the need for further assessment for the topics of Air Quality, and Noise and Vibration to a Simple Level., with surveys to be carried out for Great Crested Newts. However, during the assessment process it became apparent that due to the scale of the works, a Simple Level assessment would also be needed for Nature Conservation. In addition, due to the complexity of the study area and the elevated NO_2 concentrations, a Detailed Level local air quality assessment was undertaken. The assessment of effects on Air Quality, Noise and Vibration and Nature Conservation are presented within this EAR, which additionally considers Cumulative Effects for the Scheme.

Combined effects of the Scheme during construction would, on balance, be Neutral, as measures to minimise the temporary effects of the Scheme would be implemented through best practice measures and the preparation of a Site Waste Management Plan (SWMP) and a Construction Environmental Management Plan (CEMP). These would ensure that adverse impacts associated with construction dust, construction noise and vibration, potential pollution to watercourses, material use and the transport of materials and waste for example, are minimised.

During the operational phase of the Scheme, the combined effects are considered to be, on balance, Slight Beneficial, through the implementation of the proposed mitigation measures during construction and due to the benefits to All Travellers.

1 Introduction

1.1 Overview

This document presents the EIA that has been prepared for the proposed M2M Scheme. The EIA is presented in the form of an EAR. The proposed Scheme is being promoted by Highways England as a trial.

The Scheme would involve the control of traffic on the links between two motorways by the use of traffic signals and also the control of the main carriageway using VMSL. Scheme drawings are included within Appendix A of this EAR and a full description of the Scheme is provided in Chapter 2.

A detailed construction programme is to be developed by the appointed Contractor, with construction anticipated to commence in the first quarter of 2016. It is envisaged that the Scheme would be operational by the end of the first quarter of 2017.

1.2 Environmental Impact Assessment

1.2.1 Screening

The EIA Directive (2011/92/EU) (as amended) requires that an EIA should be completed for certain types of development that may result in a significant impact upon the environment. The process for deciding which projects require Statutory EIA and therefore the publication of an Environmental Statement (ES) is referred to as Screening. The Screening process involves a number of steps:

- Deciding whether the project falls within Annex I or II of the EIA Directive; and,
- Deciding whether an Annex II project represents a 'relevant project'.

Appropriate definitions of relevance to highways projects are given in Table 1.1.

Table 1.1 Annex I, Annex II and relevant project definitions

Descriptor	Definition in Relation to Highways Projects
Annex I	Construction of motorways and express roads. Construction of a new road of four or more lanes, or realignment and/ or widening of an existing road of two lanes or less so as to provide four or more lanes, where such new road, or realigned and/or widened section of road would be 10km or more in a continuous length.
Annex II	All other improvement road projects not listed in Annex I.
Relevant Project	A project for constructing or improving a highway where the area of the completed works together with any area occupied during the period of construction or improvement by requisite apparatus, equipment, machinery, materials, plant, spoil heaps or other such facilities exceeds 1ha or where any such area is situated in whole or in part in a sensitive area.

Statutory EIA is mandatory for all Annex I Schemes. All highways projects (excluding those considered strictly maintenance) that are not listed in Annex I, fall under Annex II of the EIA Directive. For Annex II Schemes that are identified as a 'relevant project', it must be determined through a formal screening process whether the Scheme is to result in a significant environmental impact. Findings of this

- The Environment Agency;
- English Heritage; and,
- Warrington Borough Council (WBC).

1.9 Environmental Management Plan

In accordance with IAN183/14 (Highways England, 2014), an outline Environmental Management Plan (EMP) will be prepared for the M2M Scheme, to manage any environmental effects of the Scheme and to demonstrate compliance with environmental legislation. The overarching objective of an EMP is to provide the framework for managing the environmental effects of projects, and to demonstrate compliance with environmental legislation. DMRB Volume 11, Section 2 describes the function of the EMP as primarily to highlight the project commitments to particular environmental designs, mitigation or enhancement measures and/or longer term monitoring, which have been recommended in the assessment. It provides the basis on which monitoring and auditing of the delivery of the environmental performance of the Scheme can be measured.

The key aspects and impacts of an EMP are presented within Chapter 7 of this EAR, forming an Outline EMP at this stage. These will be further developed as the scheme progresses through the design process. The EMP would inform the Construction Environmental Management Plan (CEMP) to be produced by the Contractor at the construction stage and eventually the Handover Environmental Management Plan (HEMP) which will contain essential environmental information needed for the future maintenance and operation of the asset.

2 Scheme Description

2.1 The Scheme Location

The location of the proposed M2M Scheme lies on the M6/M62 Croft Interchange. This falls within Highways England's Area 10 area (Cheshire, Greater Manchester, Merseyside and South Lancashire); although as a pilot scheme, it is not part of the Area 10 commission. Refer to Appendix C for the Scheme location.

2.2 Background to the Scheme and Scheme Objectives

Highways England is developing the concept of Motorway to Motorway Metering for application on the strategic road network. Highways England has appointed Mott MacDonald to develop a pilot system to be trialled on the M6/M62 Croft Interchange.

The aim of the M2M Scheme is to reduce the delays currently experienced on the M62 eastbound carriageway in peak periods by using traffic signals on the link roads from the M6 to "gate" the traffic. The affected links are shown in Appendix C.

2.3 Scheme Details

The M2M Scheme would involve the control of traffic on the links between the M6 and M62motorways by the use of traffic signals and also the control of the main carriageway using VMSL. These would be implemented by five gantries with individual lane speed indicators and 3 MS4 signs, with associated cabling within the verges. These would be coordinated to reduce journey times and delays.

Speed indicators may be used on the link roads from the M6 to slow traffic down on the approach to the traffic signals, although the scheme design is still to be finalised. Traffic signals timings would vary depending on the prevailing traffic conditions. The control on the link roads from the M6 and M62 motorways would be implemented in such a way that queues on the link roads would not interfere with the flow of traffic on the M6. VMSL would be used on the main carriageway to smooth the traffic into and through the section thereby leading to a reduction in lane changing and a lower speed differential between lanes. It is intended that equipment be left in-situ at the end of the trial, therefore this EAR does not consider potential decommissioning effects.

The Scheme extent is located wholly within Highways England land, thus there would be no land acquisition associated with the proposed works. The main compound would be located on land within the control of Warrington Borough Council.

Works are currently planned to commence in the first quarter of 2016 for duration of approximately eight months. Night-time working may be required therefore some artificial lighting would be present, although directional lighting during night works would minimise effects on night time visual impact.

A temporary Traffic Management Plan will be prepared for the construction phase. The Traffic Management may include lane closures, hard shoulder running and closures, temporary diversion routes

onto other Highways England managed roads and temporary signal arrangements. It is not anticipated that diversions onto local roads would be required and this has therefore not been assessed within this EAR.

2.4 Alternatives Considered

The M2M Scheme falls under Highways England's Area 10 network (Cheshire, Greater Manchester, Merseyside and South Lancashire) although as a pilot scheme, it is not part of the Area 10 commission. When appointed, Mott MacDonald inherited a concept design and has since taken this forward. Limited information therefore is available on the alternatives considered at the feasibility stage.

It is anticipated however, that the decision to 'Do Nothing' would result in an increase in the congestion already seen at the interchange.

3 Air Quality Detailed Assessment

3.1 Introduction

This chapter provides an assessment of the potential air quality impacts of the M2M Scheme in accordance with the Design Manual for Roads and Bridges (DMRB) Volume 11 Section 3, Part 1 – Air Quality (HA207/07) (HA, 2007) and the current Interim Advice Notes (IAN 174/13 and 175/13).

The Scoping Report identified that a Simple level assessment was required for air quality, however due to the complexity of the study area and the elevated NO_2 concentrations, a Detailed level local air quality assessment has been undertaken.

3.2 Legislation and Policy Context

3.2.1 Legislation

3.2.1.1 European Union

European Union (EU) Framework Directive 96/62/EEC on ambient air quality assessment and management came into force in November 1996, with implementation by Member States by May 1998. This Directive aimed to protect human health and the environment by avoiding, reducing or preventing harmful concentrations of air pollutants. As a Framework Directive, it required the European Commission to propose 'Daughter' Directives, which set air quality limit and target values, alert thresholds and guidance on monitoring and measurement for individual pollutants. The four Daughter Directives are as follows:

- Council Directive 1999/30/EC (the first Daughter Directive) relating to limit values for sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and oxides of nitrogen (NO_x), particulate matter (PM_{10}) and lead in ambient air;
- Directive 2000/69/EC (the second Daughter Directive) relating to limit values for benzene and carbon monoxide (CO) in ambient air;
- Directive 2002/3/EC (the third Daughter Directive) relating to ozone (O_3) in ambient air; and,
- Directive 2004/107/EC (the fourth Daughter Directive) relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air.

Directive 2008/50/EC on ambient air quality and cleaner air for Europe was adopted in May 2008. This Directive merges the first three existing Daughter Directives and one Council Decision into a single Directive on air quality.

3.2.1.2 England

The Air Quality Standards Regulations 2010 came into force in June 2010; they implement the EU's Directive 2008/50/EC on ambient air quality.

- IAN 175/13 'Updated air quality advice on risk assessment related to compliance with the EU Directive on ambient air quality and on the production of Scheme Air Quality Action Plans for users of DMRB Volume 11, Section 3, Part 1 'Air Quality' (HA207/07) (HA, 2013).

IAN 175/13 is currently withdrawn, but it has been included in this assessment in the absence of an updated version. The following sub-sections describe the methodology in more detail.

3.3.2 Construction Dust

Construction activities can result in temporary effects from dust. The word 'dust' usually refers to particulate matter in the size range 1-75 microns in diameter (BSI, 1987).

A qualitative assessment of potential dust effects has been undertaken, based on a review of likely dust raising activities and identification of sensitive receptors within 200m. Best practice mitigation measures have been proposed commensurate with the risk of dust effects identified.

3.3.3 Local Air Quality

The sub sections below describe the approach of the local air quality assessment. The study area, as described in Section 2.3, is considered complex due to the shape and size of the Croft Interchange. The affected road network been defined in Section 3.3.3.1 below. Additionally, there is an indication of existing exceedences of the annual mean NO_2 air quality objectives in the area (see Section 3.4 for further details).

Due to the complexity of the study area and the elevated NO_2 concentrations, a Detailed Level local air quality assessment has been undertaken.

3.3.3.1 Assessment Study Area

As noted above, the M2M Scheme would involve the control of traffic on the slip roads between the M6 and M62 eastbound motorways, by the use of traffic signals and also the control of the M62 eastbound main carriageway using VMSL. In accordance with HA207/07, the following criteria have been applied to the Do-Minimum and Do-Something scenario traffic flows in order to identify which roads are likely to be affected by the M2M Scheme (referred to as 'affected roads') to the degree that potential air quality impacts require consideration within the local air quality dispersion modelling:

- Road alignment will change by 5m or more; or,
- Daily traffic flows will change by 1,000 AADT or more; or,
- Heavy Duty Vehicle (HDV) flows will change by 200 AADT or more; or,
- Daily average speed will change by 10 km/hr or more; or,
- Peak hour speed will change by 20 km/hr or more.

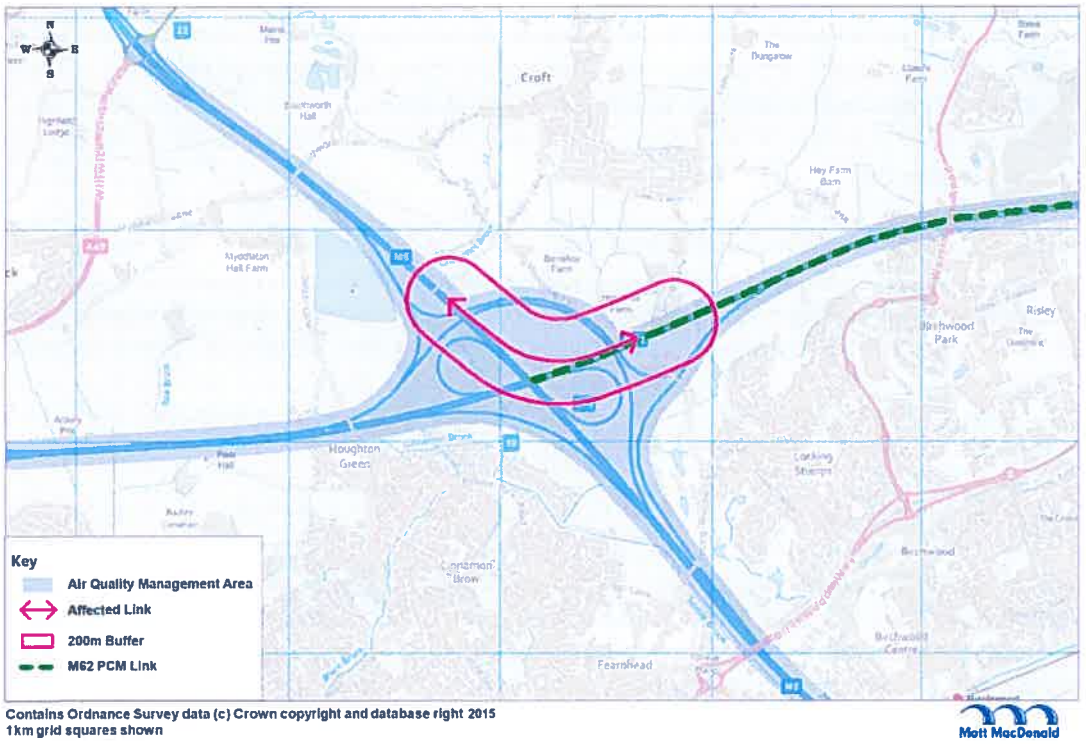
A map of the affected roads which meet the criteria above and AQMAs within the study area is presented in Figure 3.1 below. There are no sites designated for nature conservation within 200m of the affected road network. Traffic data for the assessment has been generated using the VISSIM traffic model and data

included in the dispersion model have been presented in Appendix E. Of the 32 links included in the VISSIM model, only one falls within the above criteria due to a change in peak hour speed of 20km/hr or more.

The Pollution Climate Mapping (PCM) model includes a link from the centre of the Croft Interchange that extends eastwards. The location of this link has been presented in Figure 3.1.

Emissions from road transport are generally imperceptible beyond 200m from the source (DMRB, 2007). In addition to the affected road link, all VISSIM links within 200m of the identified receptors have been included in the dispersion model.

Figure 3.1: Study Area and Key Features



Note: The affected link is the slip road between the M6 southbound and M62 eastbound which does not overlap with the PCM Link.

3.3.3.2 Traffic Data

Outputs from the M2M Scheme VISSIM traffic model have been used for the assessment. Data on vehicle flows, speed and % Heavy Duty Vehicles (HDV) were generated for the following periods in the Do-Minimum and Do-Something scenarios and are representative of flows in the study area:

- AM peak period (06:00 to 10:00);
- Inter-peak period (10:00 to 15:00);

- PM peak period (15:00 to 19:00);
- Off peak 1 period (00:00 to 06:00);
- Off peak 2 period (19:00 to :00:00); and,
- Weekend/Bank Holiday period (24 hour).

The diurnal traffic flow characteristics, and therefore emissions, are represented in the dispersion model using time varying emission factors.

3.3.3.3 Assessment Scenarios

Construction Traffic

At this stage, limited information is available on what traffic management measures would be required during this period. However, they may include:

- Lane closures for the duration of the works, with narrow lanes and speed restrictions in place (50mph); and
- Diversions if full closures are used, for example during works on slip roads.

Due to the small infrastructure changes required, it is unlikely that the construction phase would last longer than eight months and any traffic management measures required would not continuously be in a single location for more than six months. Due to the limited duration of any traffic management measures, and the likely reduced emissions associated with a 50mph speed restriction compared to normal speeds, potential impacts from any traffic management associated with the construction phase of the M2M Scheme are considered to be negligible and have not been assessed further.

On the basis of the construction works to be undertaken, construction traffic movements are considered to be insignificant compared to existing flows and therefore potential impacts from the M2M Scheme are considered to be negligible and have not been assessed further.

Operational Traffic

This assessment has considered the following scenarios:

- Base Year 2013;
- Do-Minimum (DM) Scenario 2016 (opening year); and
- Do-Something (DS) Scenario 2016.

An analysis of the traffic data for a further future year of 2031 shows that, although an increase in traffic is predicted, it is relatively small and likely to be outweighed by the improvement in vehicle emissions and future predicted background concentrations. The opening year of the M2M Scheme is therefore considered to represent the worst case within the first 15 years of opening and so no further future year has been considered.

3.3.3.4 Dispersion Model

The assessment uses a dispersion model called 'ADMS-Roads' (version 3.2); a PC-based model of dispersion in the atmosphere of pollutants released from road traffic sources, produced and validated by Cambridge Environmental Research Consultants (CERC).

3.3.3.5 Emission Factors

Defra's current guidance to Local Authorities recommends the use of the 'Emission Factor Toolkit' (EFT) to calculate road traffic emissions for dispersion modelling. Version 6.0.1 is available from Defra (Defra, 2014) and has been used for the assessment. Since the dispersion modelling was undertaken, an EFT Version 6.0.2 has been released. The emissions calculated in for this assessment are the same in both Version 6.0.1 and 6.0.2.

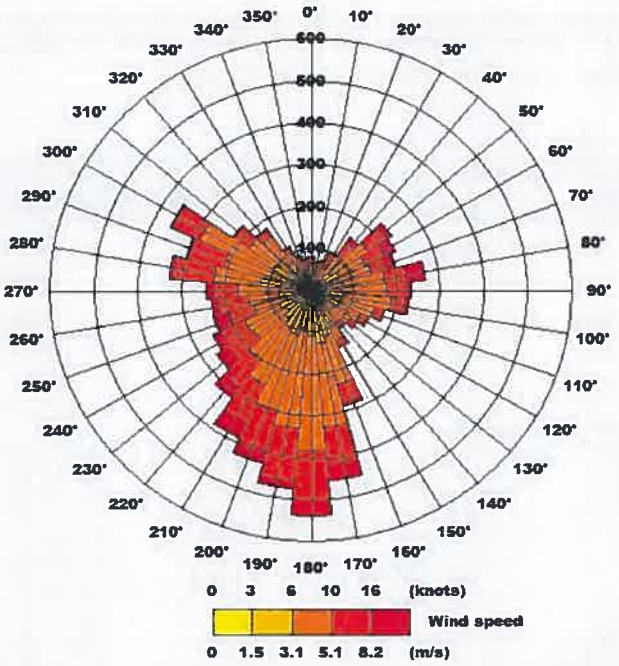
3.3.3.6 Meteorological Data

The most important meteorological parameters governing the atmospheric dispersion of emissions are wind direction, wind speed and atmospheric stability.

For meteorological data to be suitable for dispersion modelling purposes, a number of meteorological parameters need to be measured on an hourly basis. There are only a limited number of sites where the required meteorological measurements are made.

Following normal Highways England practice, data from one meteorological year has been used in this assessment taken from Manchester Airport for 2013. Manchester Airport is the nearest, most representative station with available data. A wind rose is presented in Figure 3.2 below, which shows a dominance of wind from the south.

Figure 3.2: Manchester Airport Wind rose 2013



3.3.3.7 Background Pollutant Concentrations

Only road traffic emission sources have been explicitly included within the dispersion model. Non-road traffic related emission sources have been accounted for within the assessment by assigning appropriate 'background' concentrations to modelled receptor locations. The selection of appropriate background data has been presented in Section 3.4.

3.3.3.8 NO_x to NO_2 Relationship

Research undertaken on behalf of Defra has provided a method to determine NO_2 concentrations (Defra, 2014). This method (version 4.1) has been used within this assessment and its suitability was assessed within the model verification process (see 3.3.10 below).

3.3.3.9 Receptors

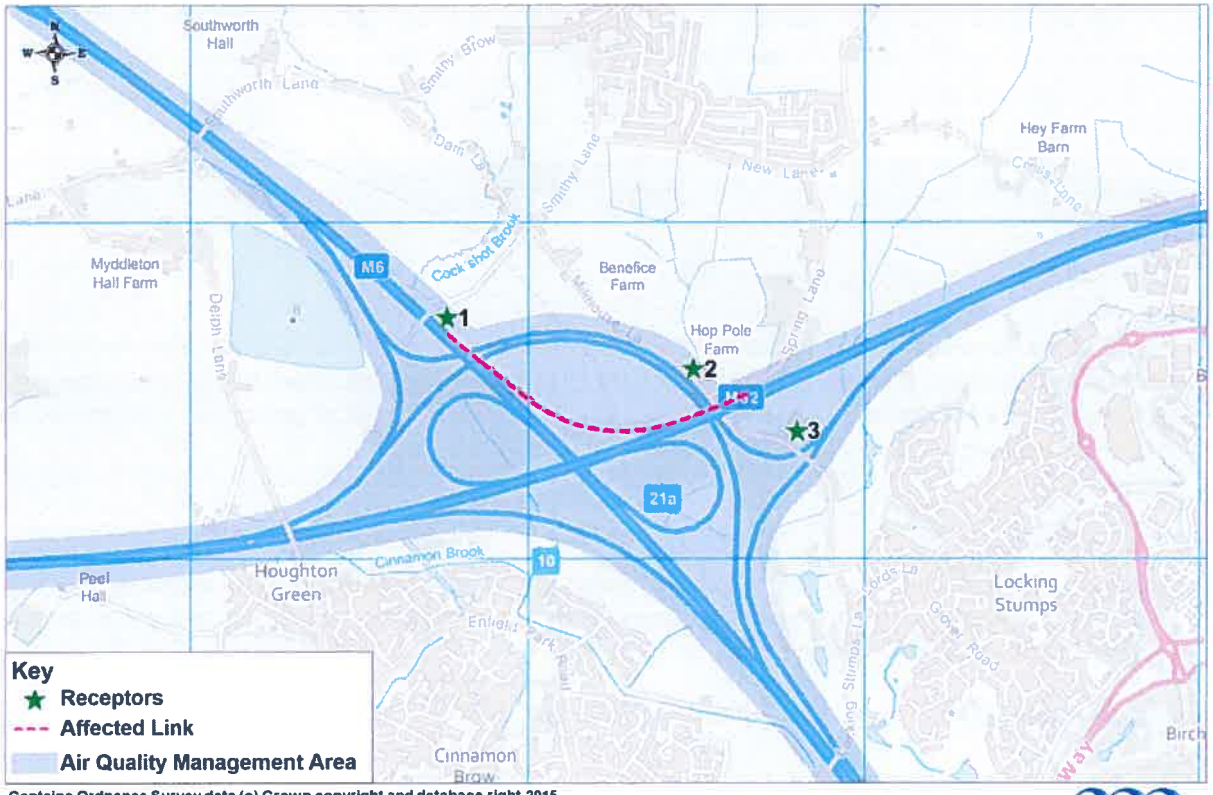
The assessment has included all sensitive receptors within 200m of the affected roads that have a reasonable risk of exceeding the air quality objectives, and those that are likely to experience the highest total concentrations and/or greatest change. The receptors identified within 200m are shown below in Table 3.3.

As noted in Section 3.2, the air quality objectives only apply in locations of relevant exposure and therefore receptors have been chosen in accordance with Table 3.2. There are no designated nature conservation sites within 200m of affected roads and therefore no further assessment of these receptors is required. Table 3.3 and Figure 3.3 below present a list of human health sensitive receptors included in the assessment and their distance from the affected link carriageway.

Table 3.3: Modelled Human Health Sensitive Receptors

Figure ID	Receptor Name	X	Y	Distance from Affected Link (m)
1	Sandsfield Cottage	362759	392719	51
2	Hop Pole Farm	363491	362566	132
3	Johnson's Tenement	363797	392382	183

Figure 3.3: Modelled Sensitive Receptors



Contains Ordnance Survey data (c) Crown copyright and database right 2015
1km grid squares shown

3.3.3.10 Model Verification

Dispersion modelling has associated with it an inherent level of uncertainty, primarily as a result of:

- Uncertainties with traffic flow and emissions data;
- Uncertainties with recorded meteorological data; and
- Simplifications made in the model algorithms or post processing of the data that describe atmospheric dispersion or chemical reactions.

This uncertainty has been addressed within the assessment by carrying out model verification. Details of the model verification and use of an adjustment factor are presented in Appendix D. The model verification is based on the relevant monitoring data currently available.

3.3.3.11 Assessment of 1 Hour NO_2 and 24 Hour PM_{10} Concentrations

Government guidance (Defra, 2009) advises that exceedences of the 1 hour mean objective for NO_2 are only likely to occur where annual mean concentrations are 60µg/m^3 or above. Therefore annual mean NO_2 concentrations of 60µg/m^3 or more are used as an indicator of potential exceedences of the 1 hour mean NO_2 objective.

The prediction of daily mean concentrations of PM_{10} is available as an output option within the ADMS roads dispersion model for comparison against the short term air quality objective. However, as the model output for annual mean concentrations is considered more accurate than the modelling of the daily mean, an empirical relationship has been used to determine daily mean PM_{10} concentrations.

In accordance with Government guidance (Defra, 2009), the following formula has been used:

$$\textit{No. of 24-hour mean exceedences} = -18.5 + 0.00145 \times \textit{annual mean}^3 + (206 / \textit{annual mean})$$

3.3.3.12 Compliance with the EU Directive on Ambient Air Quality

IAN 175/13 provides advice on a risk assessment approach related to compliance with the EU Directive on ambient air quality. The first step of the approach is to identify whether any of the affected roads coincide with Defra's Pollution Climate Mapping (PCM) model. This has been carried out and it has been confirmed that none of the affected road network coincides with the PCM model. Although the affected link does not fully overlay the PCM model, the final section of the M6 southbound to M62 eastbound slip road could be considered to partially intersect a PCM model link. Therefore, further consideration has been given to the change in concentrations caused by the Scheme on this link.

Table 3.4 presents the equivalent opening year PCM NO_2 concentration on the link intersected by the Scheme affected link. The equivalent opening year PCM NO_2 concentration is below 40µg/m^3.

Table 3.4: Calculating Equivalent Opening Year PCM NO_2 Concentration

Step	Calculation	Total NO_2 Concentrations ($\mu g/m^3$)
Scheme Opening Year	2016	-
Preceding Year PCM NO_2	2015	38.8
Following Year PCM NO_2	2020	24.2
Annual Rate of Change	(38.8 - 24.2) / 5	2.9
Equivalent Opening Year PCM NO_2 Concentration	38.8 – 2.9	35.9

3.3.3.13 Evaluating Significance

IAN 174/13 provides advice for evaluating significant local air quality effects for public exposure and designated ecosystems. Evaluation of the significance of local air quality impacts has been undertaken in accordance with IAN 174/13, a summary of which is provided below.

As noted above, sensitive receptors that have a reasonable risk of exceeding an air quality threshold or experience the highest total concentrations and/or greatest change, have been assessed in both a Do-Minimum and Do-Something scenario. The difference in pollutant concentration between the two scenarios is used to describe the 'magnitude' of change in accordance with Table 3.5.

Table 3.5: Magnitude of Change Criteria

Magnitude of Change in Concentration	Value of Change in Annual Average NO2 and PM10
Large (>4)	Greater than full MoU value of 10% of the air quality objective ($4\mu g/m^3$)
Medium (>2 to 4)	Greater than half of the MoU ($2\ \mu g/m^3$), but less than the full MoU ($4\mu g/m^3$) of 10% of the air quality objective
Small (>0.4 to 2)	More than 1% of objective ($0.4\mu g/m^3$) and less than half of the MoU i.e. 5% ($2\mu g/m^3$). The full MoU is 10% of the air quality objective ($4\ \mu g/m^3$)
Imperceptible (</= 0.4)	Less than or equal to 1% of objective ($0.4\mu g/m^3$)

Notes: MoU = Measure of Uncertainty (10% of the objective)

The number of receptors where changes are greater than imperceptible, and where concentrations exceed the air quality objectives in the Do-Minimum or Do-Something scenario have been compared to the guideline bands presented in Table 3.6.

Table 3.6: Guideline to Number of Properties Constituting a Significant Effect

Magnitude of Change in Concentration	Number of Receptors With:	
	Worsening of air quality objective already above objective or creation of a new exceedence	Improvement of an air quality objective already above objective or the removal of an existing exceedence
Large (>4)	1 to 10	1 to 10
Medium (>2 to 4)	10 to 30	10 to 30
Small (>0.4 to 2)	30 to 60	30 to 60

The information compiled to complete Table 3.6 has then been used along with the following key criteria (amongst others) to determine the overall evaluation of local air quality significance:

- Is there a risk that environmental standards will be breached?
- Is there a high probability of the effect occurring?
- Will there be a large change in environmental conditions?
- Will the effect continue for a long time?
- Will many people be affected?
- Is there a risk that protected sites, areas, or features will be affected?
- Will it be difficult to avoid, or reduce, or repair, or compensate for the effect?

3.3.4 Regional Impacts

In accordance with HA207/07, the following criteria have been applied to the Do-Minimum and Do-Something scenario traffic flows in order to identify which roads are likely to be affected by the M2M Scheme (referred to as 'affected roads') to the degree that potential air quality impacts require consideration within the regional air quality dispersion modelling:

- A change of more than 10% in AADT; or,
- A change of more than 10% to the number of heavy duty vehicles; or,
- A change in daily average speed of more than 20km/hr.

Following a comparison of the traffic flows, presented in Appendix E, and the above criteria, no further assessment of regional impacts has been made. As the M2M Scheme focusses on changing a single motorway interchange, it is concluded that it would have a negligible effect on regional air quality.

3.4 Existing Baseline

3.4.1 Overview

This Section provides a review of information available on baseline pollutant concentrations relevant to the study area. This includes information available from WBC's Review and Assessment work and a Highways England NO_2 diffusion tube monitoring survey. Predicted concentrations at identified receptors from the 2013 Baseline modelling are presented in Section 3.5.

3.4.2 Local Authority Review and Assessment Information

The M2M scheme is located within the administrative area of WBC, which has declared three AQMAs due to potential exceedences of the annual mean NO_2 objective, primarily as a result of road traffic emissions. As shown in Figure 3.1 above, the 'Motorway' AQMA encompasses the Croft Interchange and covers a 50m continuous strip on both sides of the M6, M62 and M56 motorway corridors.

WBC carries out monitoring using NO_2 diffusion tubes at 49 locations. Although the Local Authority monitoring covers a wide area, only two sites are within the study area. The sites are located in a field 7m and 30m west of the M6 southbound carriageway, with concentrations between 69 and 86 $\mu g/m^3$ in 2013.

Monitored annual mean NO_2 concentrations data are available for recent years and have been presented within Table 3.7.

Table 3.7: WBC NO_2 Diffusion Tube Monitoring

Site ID	Coordinates (British National Grid)		Distance from Edge of Nearest Carriageway (m)	Annual Mean NO_2 (µg/m³) (Data Capture %)		
	X	Y		2011	2012	2013[a]
WA16 M6 Woolston	365605	389959	7	75.1 (92%)	77.7 (92%)	86.3 (92%)
WA17 M6 Woolston	365635	389970	30	60.6 (100%)	70.8 (100%	69.3 (92%)

Source: (Warrington Borough Council, 2012, 2013, 2014)
Note: [a] Bias adjusted: 1.03

3.4.3 Highways England Diffusion Tube Monitoring

There are two NO_2 diffusion tube monitoring surveys within the general area. Both surveys commenced in August 2013 and are ongoing. Monitoring has been carried out and reported for 66 locations, the majority of which are roadside sites.

Details of monitoring locations that are representative of the study area have been presented in Table 3.8. Results from August 2013 to December 2013 have been bias adjusted and annualised in accordance with Defra Guidance (Defra, 2009).

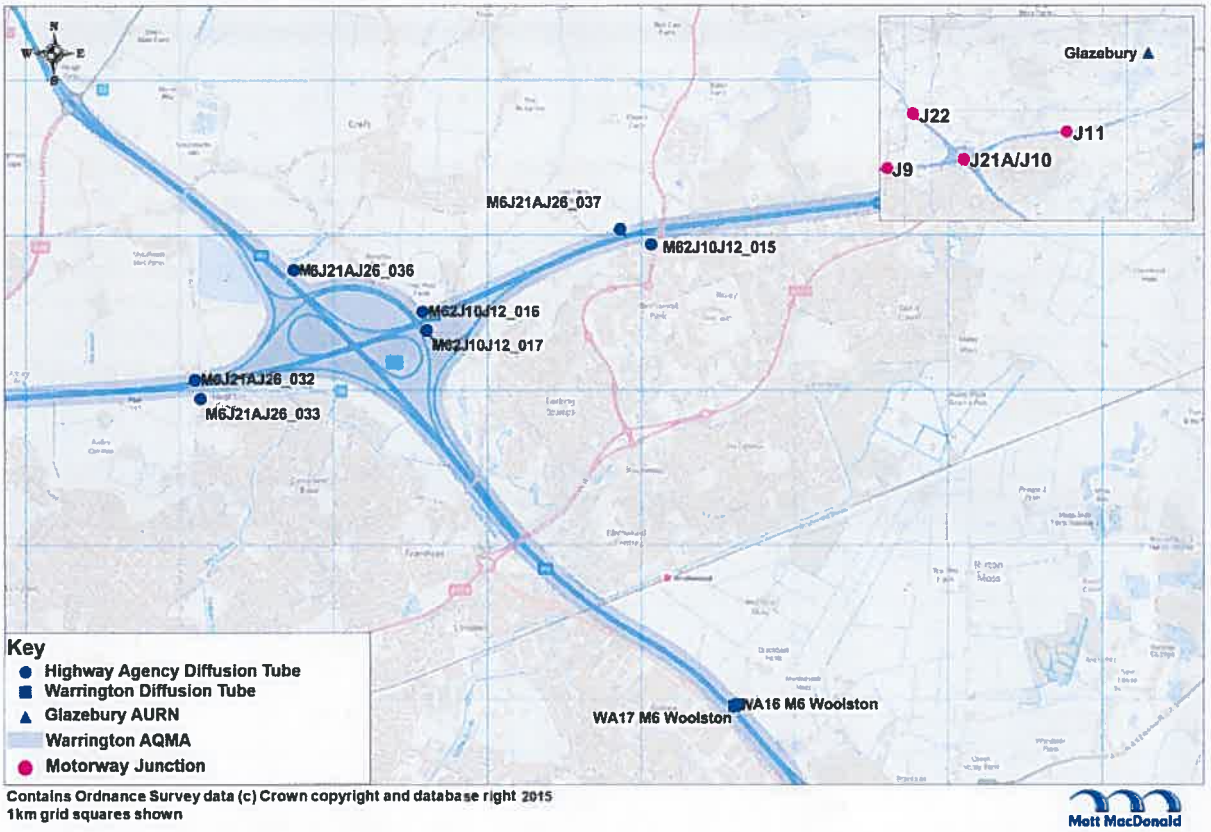
The M2M Scheme monitoring data shows that concentrations are generally above the annual mean NO_2 objective within the study area. Monitoring representative of modelled receptors close to the motorway, as presented in Table 3.8 below, shows annual mean NO_2 concentrations.

Table 3.8: Highways England NO_2 Diffusion Tube Monitoring

Site ID	Coordinates (British National Grid)		Distance from Edge of Nearest Carriageway (m)	5 Month Average (µg/m³) (Bias Adjusted)	Equivalent Annual Mean (µg/m³)
	X	Y			
M6J21AJ26_032	362094	392067	10m	56.5	58.1
M6J21AJ26_033	362131	391945	79m	29.9	30.7
M6J21AJ26_036	362739	392774	62m	42.7	43.9
M6J21AJ26_037	364860	393037	41m	44.3	45.5
M62J10J12_015	365062	392939	72m	38.0	39.1
M62J10J12_016	363575	392506	44m	49.7	51.1
M62J10J12_017	363600	392386	36m	57.9	59.5

Note: Bias adjustment factor: 0.87
Annualisation Factor: 1.03

Figure 3.4: Location of Highways England NO_2 Diffusion Tube Monitoring



3.4.4 Defra Background Concentration Estimates

Defra provides estimates of background pollution concentrations for NO_X, NO_2 and PM_{10} across the UK for each one kilometre grid square for every year from 2011 to 2030. Future year projections have been developed from the base year for the background maps which is currently 2011. The maps include a breakdown of background concentrations by emission source, including road and industrial sources which have been calibrated against 2011 UK monitoring data.

These have been taken from Defra background pollutant concentration maps (Defra, 2014) and have been sector adjusted to remove motorway contributions to avoid double counting in the modelling assessment. A summary of the range of concentrations used within the study area is presented in Table 3.9 below.

Table 3.9: Summary Defra Background Pollutant Map Data

	2013			2016		
	NOx	NO_2	PM_{10}	NO_x	NO_2	PM_{10}
Minimum ($\mu g/m^3$)	27.1	16.7	16.7	24.0	17.4	16.1
Maximum ($\mu g/m^3$)	22.0	22.0	18.0	27.8	19.9	17.4

A comparison of monitoring data taken from the Glazebury Automatic Urban and Rural Network (AURN) monitoring site and the total Defra background pollutant concentrations has been undertaken for the years 2010 to 2013. As presented in Table 3.10 below, the comparison shows generally good agreement between the two data sources. In 2013, the Defra background pollutant concentrations were slightly higher than monitored background concentrations at Glazebury. As the Defra Background concentrations are generally consistent with the monitored values, it is considered appropriate to use the Defra background pollutant concentrations for this assessment. The location of the Glazebury monitoring site is presented in Figure 3.4 above.

Table 3.10: Comparison of Monitored Background NO_2 Concentrations and Defra Background Pollutant Map Data

Year	Pollutant	Glazebury AURN	Data Capture	Defra Background
2010	NO_x	34.8	99%	24.2
	NO_2	19.4		17.3[c]
2011	NO_x	26.5	97%	23.6
	NO_2	18.3		17.0
2012	NO_x	32.7	77%	23.0
	NO_2	19.0		16.6
2013	NO_x	21.9	99%	22.4
	NO_2	14.7		16.2

Notes: [a] – Located at 369755,396030.
[b] – Grid square 368500,396500
[c] – calculated using Defra back cast tool for years before the current base year 2011
Conc. – Concentrations in $\mu g/m^3$
DC – Annual Data Capture (%)
'-' = Modelled concentrations so DC not relevant

3.5 Assessment of Impacts

3.5.1 Construction Dust

This assessment has assumed that construction activities would be confined to areas where new infrastructure would be installed e.g. gantries and speed posts.

The duration of the construction phase is expected to last approximately eight months. There are approximately 50 residential properties and 1 commercial unit (a public house) within 200m of the construction area. Based on the likely construction activities and their low dust raising potential, the temporary nature of the construction phase and the location of sensitive receptors, potential dust impacts

would be suitably controlled to avoid loss of amenity or nuisance using appropriate mitigation measures. These are presented in Section 3.6.1.

3.5.2 Local Air Quality - NO_2 Results

NO_2 pollutant concentrations have been predicted at the receptor points identified within Section 3.3.3.9 and Table 3.3 and are presented within Table 3.11. No other receptors were identified within 200m and therefore no other receptors have been modelled. Annual mean NO_2 concentrations at Receptor 1 are predicted to exceed the annual mean air quality standard of 40µg/m^3. The M2M Scheme is predicted to change annual mean NO_2 concentrations by 0.1µg/m^3 at this receptor location; but this change in annual mean NO_2 concentration is considered 'imperceptible'.

Table 3.11: Modelled Annual Mean NO_2 Concentrations

	NO_2 Annual Mean Concentration (µg/m^3)			
Receptor	2013 Base	2016 DM	2016 DS	Change
1	53.7	44.4	44.5	0.1
2	40.8	33.8	33.9	0.1
3	35.6	29.8	29.8	0.0

Notes: DM – Do Minimum (i.e. without the Scheme)
DS – Do Something (i.e. with the Scheme)

Where outdoor amenities are available, such as balconies and gardens, the short term objective should be applied. However, as the NO_2 annual mean concentration is not predicted to exceed 60µg/m^3, the short term objective is not likely to be exceeded, as discussed in Section 3.3.3.11 and has therefore not been considered further.

3.5.3 Local Air Quality - PM_{10} Results

PM_{10} pollutant concentrations have been predicted at the receptor points identified within Section 3.3.3.9 and are presented within Table 3.12. The dispersion modelling predicts that there will be no change in annual mean PM_{10} concentrations as a result of the M2M Scheme.

Table 3.12: Modelled Annual Mean PM_{10} Concentrations

	PM_{10} Annual Mean Concentration (µg/m^3)			
Receptor	2013 Base	2016 DM	2016 DS	Change
1	20.5	19.9	19.9	0.0
2	19.5	18.9	18.9	0.0
3	19.1	18.5	18.5	0.0

The predicted number of days when PM_{10} concentrations exceed the short term objective of 50 µg/m^3 are well below the 35 day threshold given above in Table 3.1, with no changes between the Do Minimum and Do Something scenarios.

3.5.4 Assessment of Significance

All changes are predicted to be less than 0.4µg/m^3, and therefore are considered 'imperceptible' and therefore in accordance with IAN 174, are considered not significant and can be scoped out of the compliance risk assessment.

3.6 Mitigation Measures

3.6.1 Construction Dust

The Contractor would ensure works shall be carried out in accordance with the Best Practicable Means, as described in Section 79 (9) of the Environmental Protection Act (EPA) 1990, to reduce fumes or emissions which may impact upon air quality. This would include but not be limited to the following, which would be included within the CEMP:

- Avoid double handling of materials;
- Minimise height of stockpiles and profile to minimise wind-blown dust emissions and risk of pile collapse;
- Locate stockpiles out of the wind (or cover, seed or fence) to minimise the potential for dust generation;
- Ensure that all vehicles with open loads of potential dusty materials are securely sheeted or enclosed;
- Provide a means of removing mud and other debris from wheels and chassis of vehicles leaving the site. This may involve a simple coarse gravel running surface or jet wash, or in the case of a heavily used exit point, wheel washers;
- Maintain a low speed limit on site to prevent the generation of dust by fast moving vehicles;
- Damp down surfaces in dry conditions;
- Water should be sprayed during cutting / grinding operations (i.e. cutting curb slabs); and
- All vehicle engines and plant motors shall be switched off when not in use.

3.6.2 Operational phase

No mitigation measures are required for operational local air quality impacts.

3.7 Conclusions

The M2M Scheme is to install a metered junction between the M6 Junction 21a and M62 Junction 10 eastbound carriageway.

This Section of the EAR provides an assessment of the potential air quality impacts of the M2M Scheme in accordance with DMRB Volume 11 Section 3, Part 1 – Air Quality (HA207/07) and relevant IANs.

A qualitative assessment of potential construction dust effects has been undertaken, based on a review of likely dust raising activities and identification of sensitive receptors within 200m. Potential dust impacts would be suitably controlled using the best practice mitigation measures proposed. Potential construction

Appendix D. Air Quality Model Verification

D.1 Methodology

Verification of modelled 2013 annual mean NO_2 concentrations has been carried out using monitoring results from a number of relevant diffusion tube sites within the study area.

Data from Local Authority and Highways England monitoring were reviewed and only sites that are within the VISSIM model study area and representative of receptors included within the dispersion modelling have been included within the verification process.

Two of the Local Authority monitoring sites meet this criterion (tubes WA16 and WA17) and are located in a field encompassed by the M6 southbound carriageway, Nicol Avenue and Moss Lane.

A number of Highways England monitoring sites have been included within the model verification. The data used are annualised mean NO_2 concentrations from August to December 2013 (5 months of data).

There Local Authority and Highways England both carry out monitoring at additional sites, however they are not considered to be representative of the study area or fall outside the study area.

As no suitable monitoring data are available to verify modelled PM_{10}, the verification has been carried out for NO_2 only. Given the low PM_{10} concentrations within the study area, and the low potential for impact associated with the M2M Scheme, verification of PM_{10} is not considered necessary.

Table D.1 presents the monitoring data used within the model verification.

Table D.1: Monitoring Data used within the Model Verification

Site ID	Type	Annual Mean (µg/m^3)	
		NO_x[a]	NO_2
WA16 M6 Woolston	Diffusion Tube	217.7	86.3
WA17 M6 Woolston	Diffusion Tube	156.3	69.3
M6J21AJ26_032[b]	Diffusion Tube	122.7	58.1
M6J21AJ26_033	Diffusion Tube	50.1	30.7
M6J21AJ26_036[b]	Diffusion Tube	82.3	43.9
M6J21AJ26_037	Diffusion Tube	86.1	45.5
M62J10J12_015	Diffusion Tube	67.9	39.1
M62J10J12_016	Diffusion Tube	101.0	51.1
M62J10J12_017	Diffusion Tube	125.9	59.5

Notes:
[a] Derived from NO_2 to NO_x calculation
[b] Based on 4 months as 5th month not available

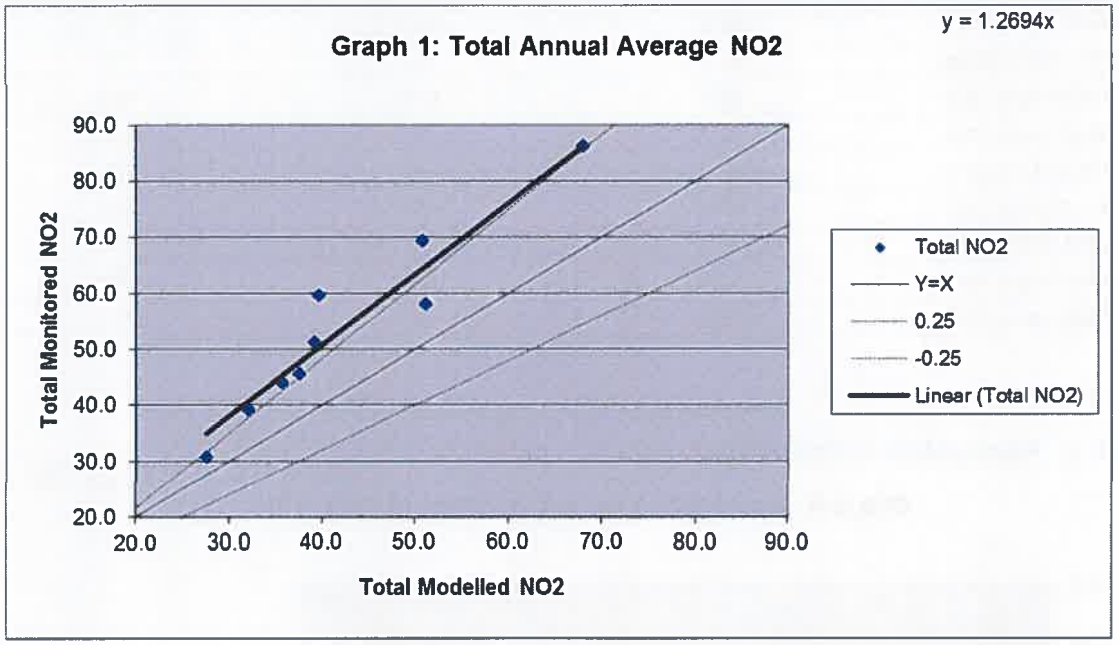
D.2 Results

Table D.2 and Figure D.1 present the unadjusted modelling results for NO2 at the selected monitoring locations. It can be seen that the modelled NO_2 concentrations at all locations are below the monitored values. Following a check of model input parameters, no other systematic under-prediction has been identified. On this basis it has been concluded that the model is under predicting annual mean NO_2 concentrations within the study area. Therefore, an adjustment factor has been calculated.

Table D.2: Unadjusted Model Verification Results

Site ID	Monitored Road NO_x (µg/m^3)	Modelled Road NO_x (µg/m^3)	Monitored Total NO_2 (µg/m^3)	Modelled Total NO_2 (µg/m^3)	Total NO_2 % Difference
WA16 M6 Woolston	217.7	120.7	86.3	68.1	-21.1
WA17 M6 Woolston	156.3	67.3	69.3	50.8	-26.7
M6J21AJ26_032	122.7	75.0	58.1	51.1	-12.0
M6J21AJ26_033	50.1	13.9	30.7	27.5	-10.3
M6J21AJ26_036	82.3	34.9	43.9	35.7	-18.7
M6J21AJ26_037	86.1	38.0	45.5	37.6	-17.4
M62J10J12_015	67.9	17.1	39.1	32.1	-17.7
M62J10J12_016	101.0	40.6	51.1	39.2	-23.3
M62J10J12_017	125.9	41.9	59.5	39.7	-33.3

Figure D.1: Unadjusted Model Verification Results



An adjustment factor of 1.60 has been applied to the study area.

Table D.3 and Figure D.2 present the adjusted modelled NO2 with monitored NO2 at the verification sites. The adjustment factor is applied to the modelled road NO_x contributions and added to the background NO_x to give total corrected NO_x at the verification site. The NO_x to NO_2 conversion has been applied to these values to provide the total adjusted modelled NO_2.

Figure D.2 shows that after the model has been adjusted and the latest NOx to NO2 conversion is applied the model is performing well with seven out of nine of the modelled sites within 10% and the remaining two within 25% of the monitored concentrations.

Table D.3: Adjusted Model Verification Results

Site ID	Monitored Total NO_2 ($\mu g/m^3$)	Modelled Total NO_2 ($\mu g/m^3$)	% Difference
WA16 M6 Woolston	86.3	88.1	2.1
WA17 M6 Woolston	69.3	64.1	-7.5
M6J21AJ26_032	58.1	65.6	13.0
M6J21AJ26_033	30.7	31.4	2.3
M6J21AJ26_036	43.9	44.2	0.6
M6J21AJ26_037	45.5	46.6	2.4
M62J10J12_015	39.1	36.7	-6.0
M62J10J12_016	51.1	48.6	-4.9
M62J10J12_017	59.5	49.3	-17.1

Figure D.2: Adjusted Model Verification Result